FIG. 1

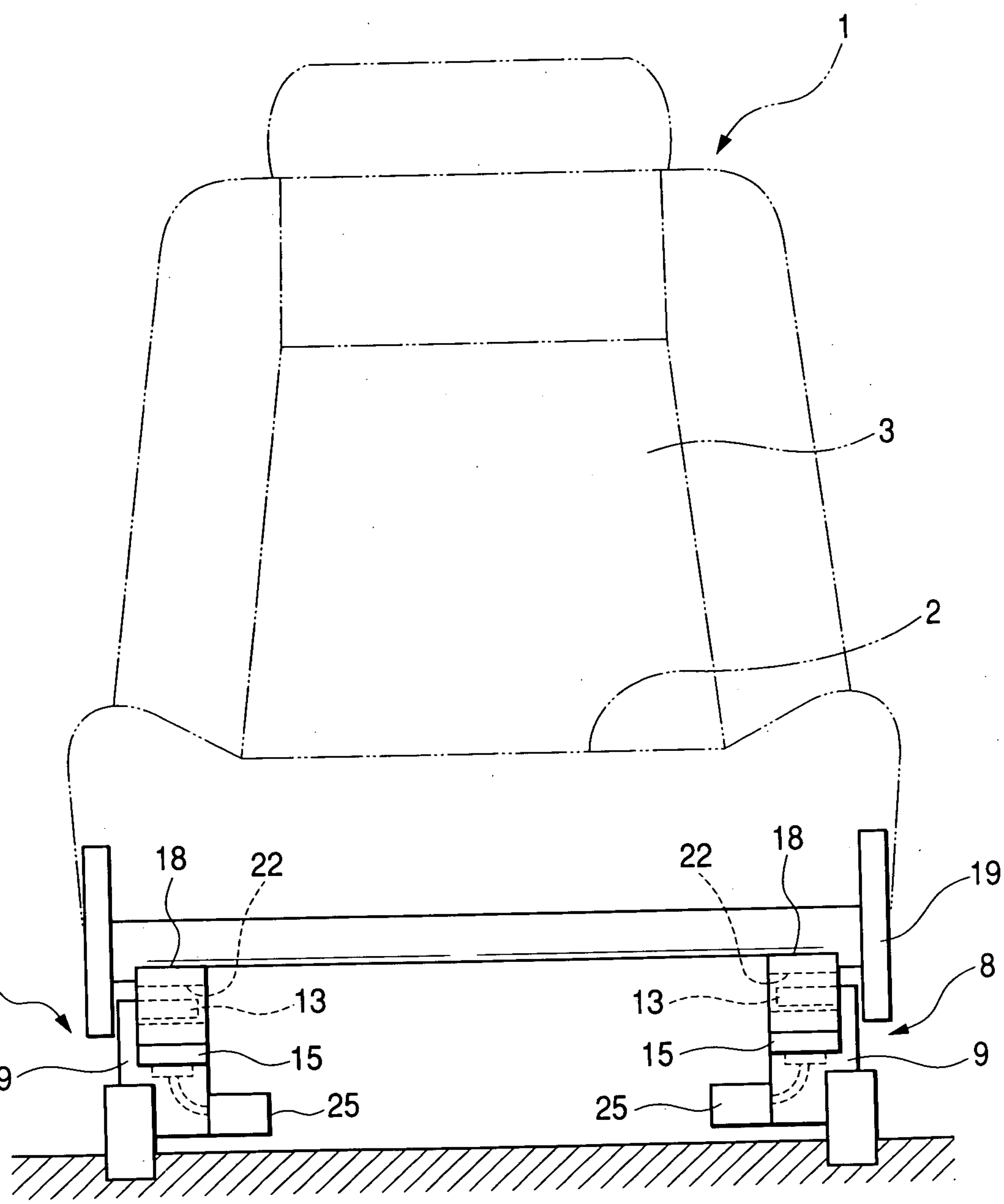


FIG. 2(a)

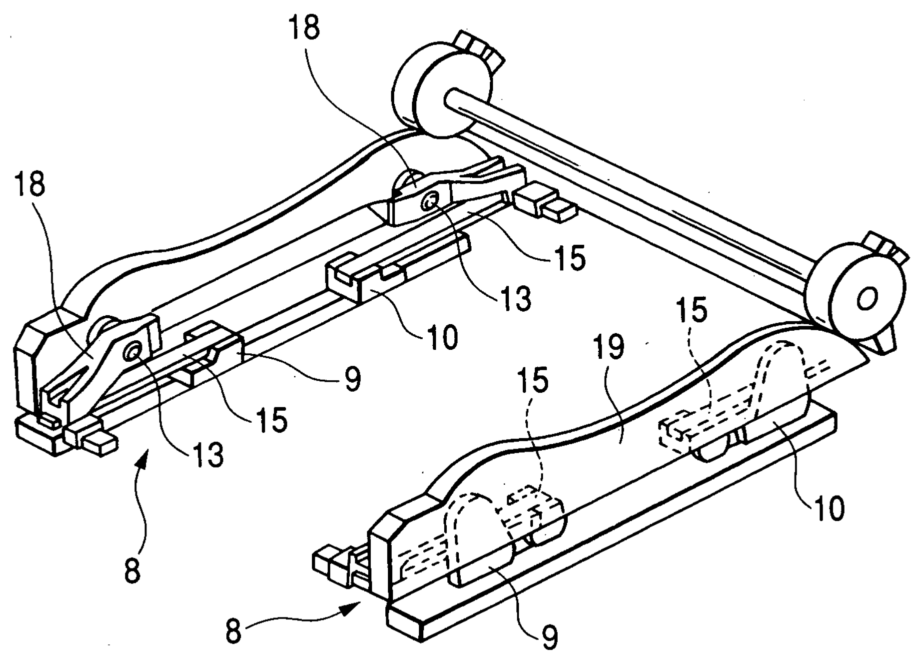

18
18
15
13
10
15
9
19
15
15
13
8
10
8
9

FIG. 2(b)

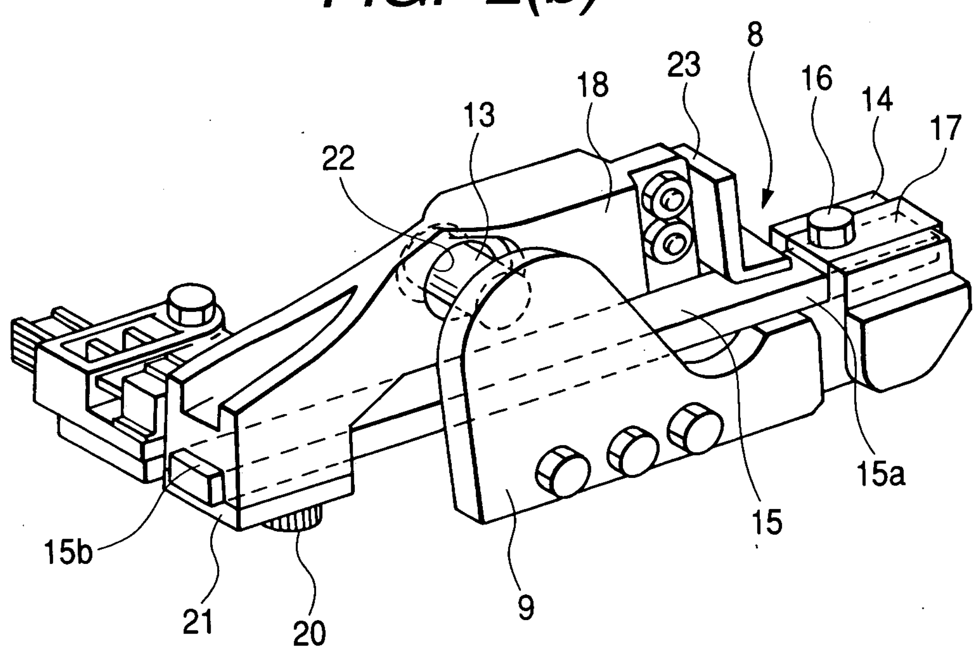

8
23
18
16
14
13
17
22
15a
15
15b
21
20
9

FIG. 3

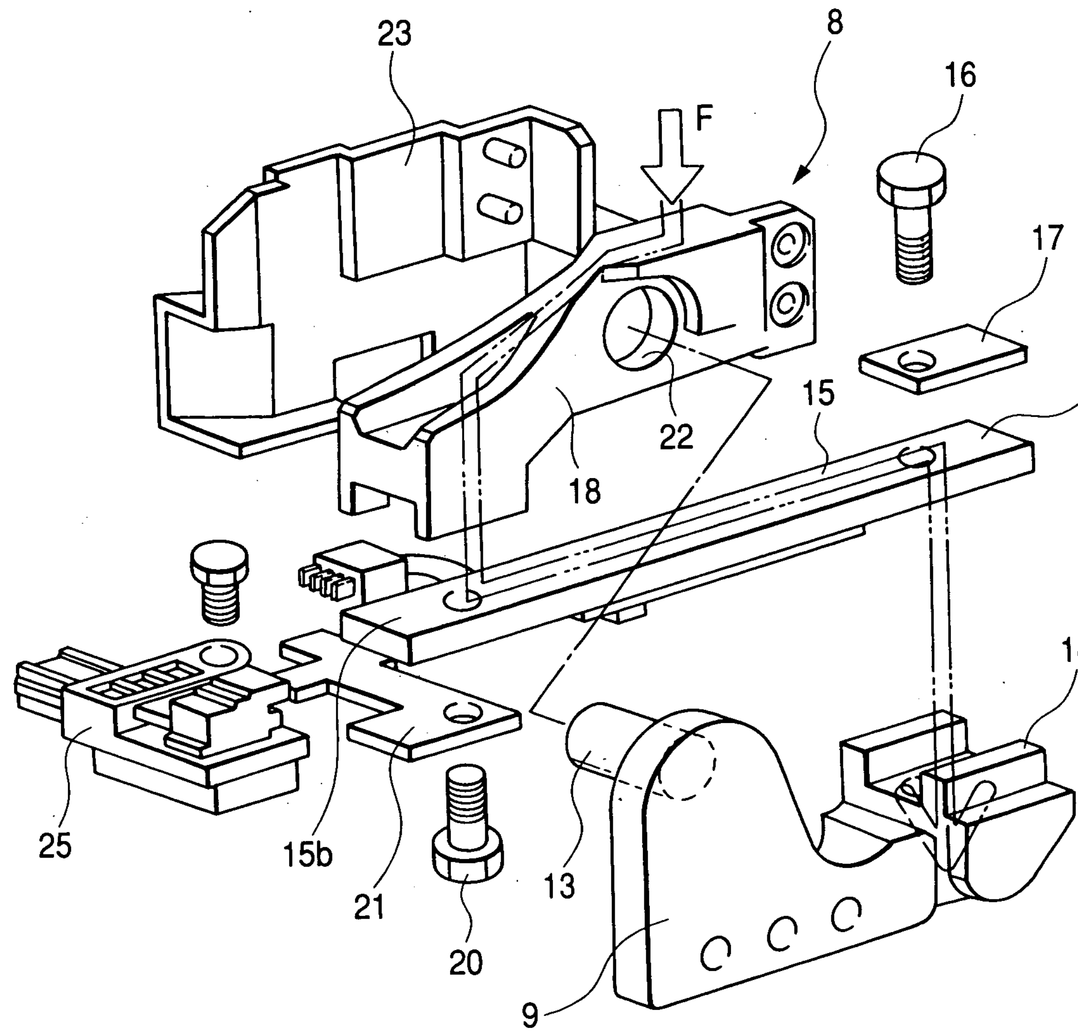


FIG. 4(a)

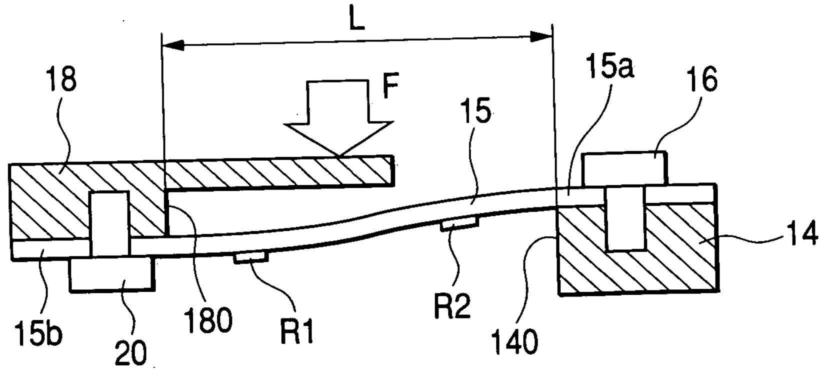


FIG. 4(b)

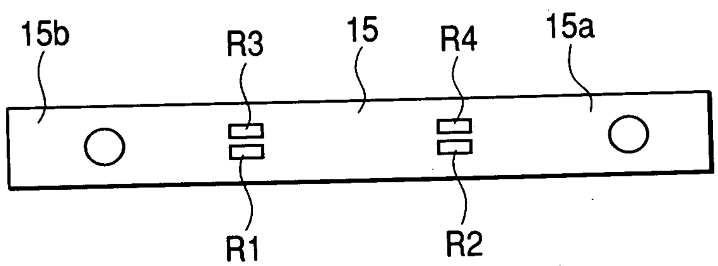


FIG. 4(c)

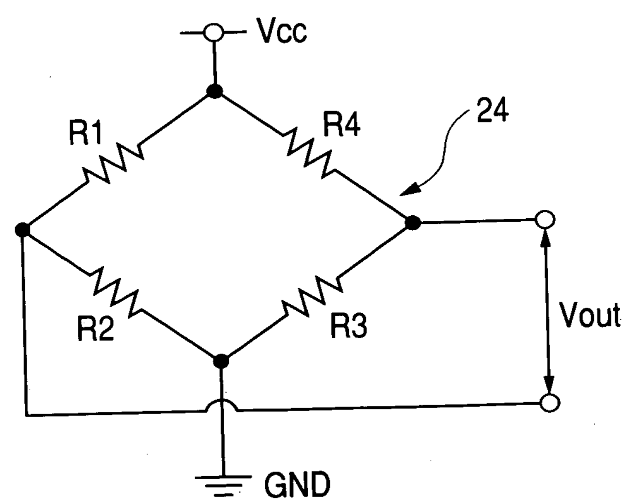


FIG. 5(a)

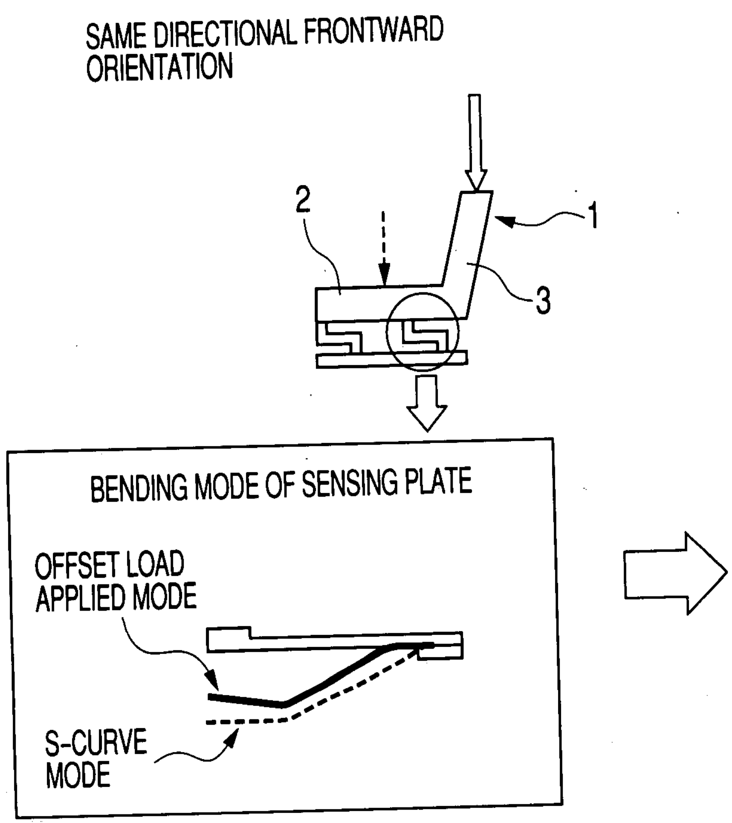

SAME DIRECTIONAL FRONTWARD ORIENTATION
1
2
3
BENDING MODE OF SENSING PLATE
OFFSET LOAD APPLIED MODE
S-CURVE MODE

FIG. 5(b)

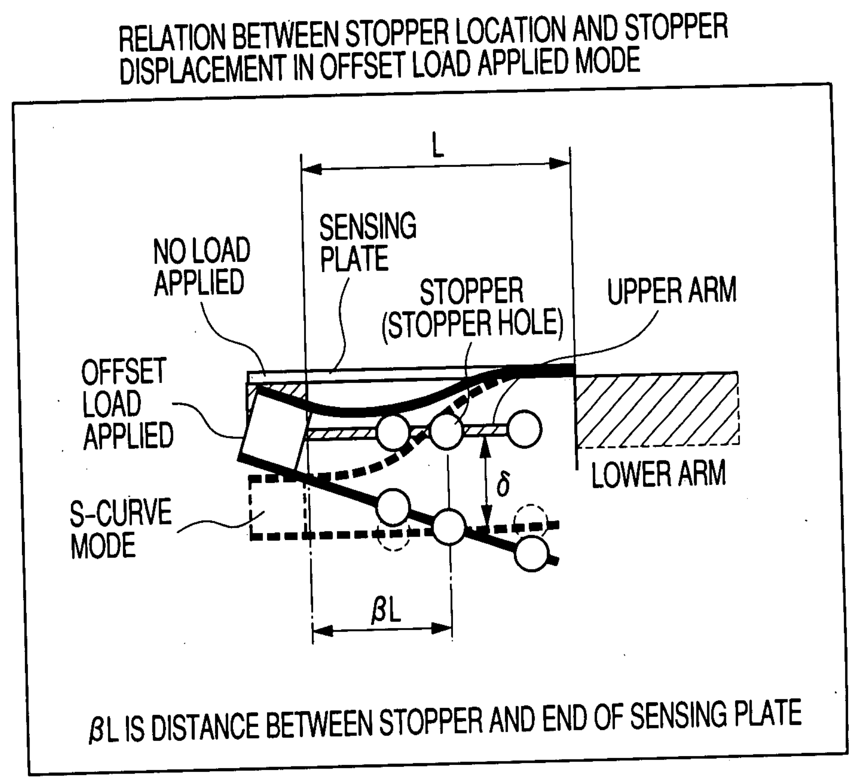

RELATION BETWEEN STOPPER LOCATION AND STOPPER DISPLACEMENT IN OFFSET LOAD APPLIED MODE
L
SENSING PLATE
NO LOAD APPLIED
STOPPER (STOPPER HOLE)
UPPER ARM
OFFSET LOAD APPLIED
LOWER ARM
δ
S-CURVE MODE
βL
βL IS DISTANCE BETWEEN STOPPER AND END OF SENSING PLATE

FIG. 6

TABLE I

BENDING MODE AND DYNAMIC MODEL UPON APPLICATION OF OFFSET LOAD

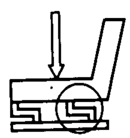
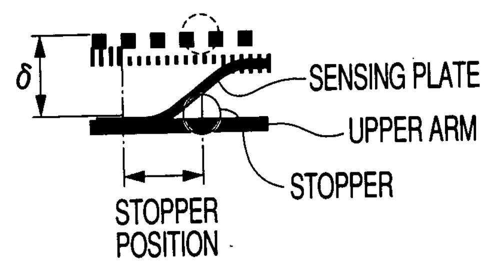
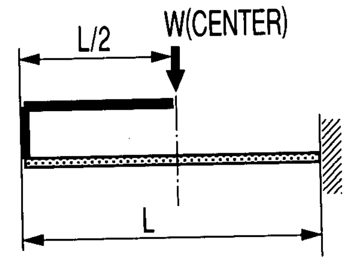
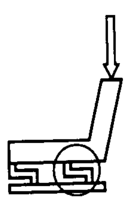
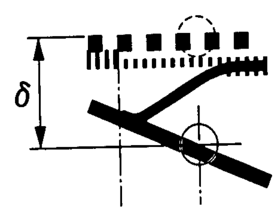
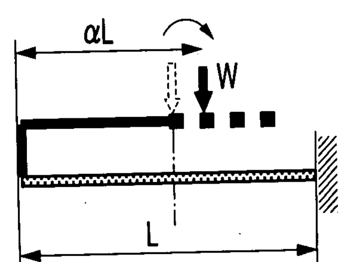
	APPLIED MODE OF LOAD	BENDING MODE	DYNAMIC MODEL CAUSING BENDING AS ILLUSTRATED LEFT
IDEAL S-CURVE BENDING	CUSHION-LOADED MODE 	STOPPER DISPLACEMENT 	
OFFSET LOAD BENDING	SEAT BACK-LOADED MODE 	INPUT OF GREAT ROTATION MOMENT TO SENSING PLATE 	SHIFT BY ROTATION MOMENT TO FIXED END SIDE 

FIG. 7

TABLE II

SENSOR INSTALLED ORIENTATION AND BENDING MODE UPON APPLICATION OF OFFSET LOAD

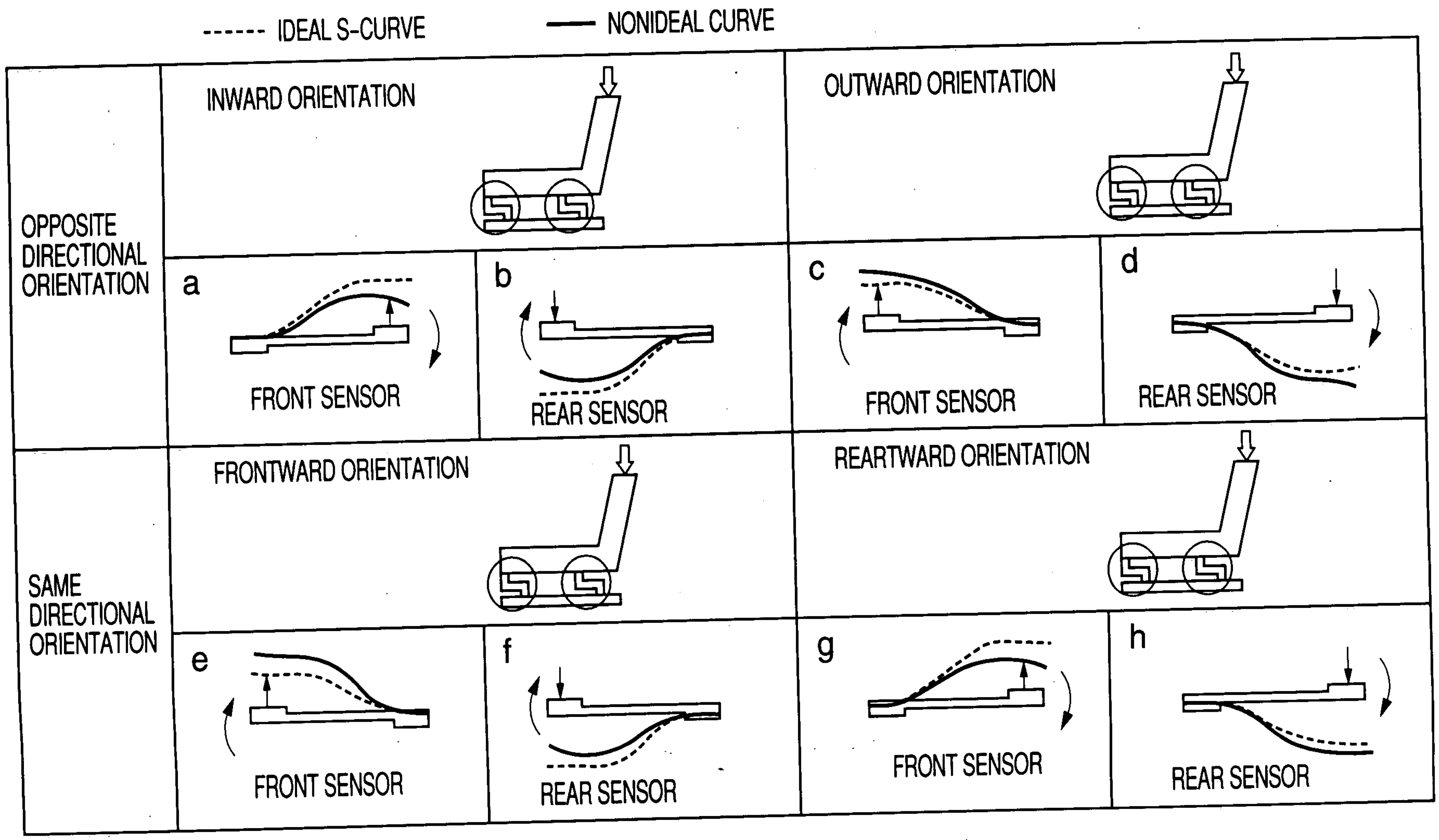
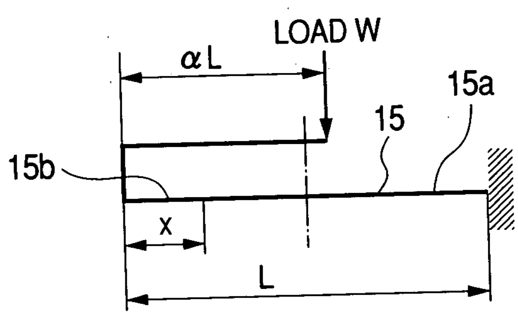


FIG. 8

STOPPER DISPLACEMENT EQUATION



$$M(x)=Wx-\alpha LW \cdots (1)$$

$$\frac{d^2y}{dx^2}=\frac{-M}{EI}=\frac{W}{EI}(\alpha L-x)$$

ANGLE OF INCLINATION OF SENSING PLATE

$$Ik(x)=\frac{dy}{dx}$$

$$=\frac{W}{2EI}\{-x^2+2\alpha L\cdot x+(1-2\alpha)L^2\} \cdots (2)$$

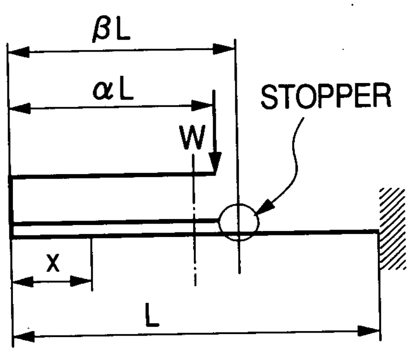
DISPLACEMENT OF SENSING PLATE
(EXPRESSED BY POSITIVE VALUE IN DOWNWARD DIRECTION)

$$Yk(x)=\int Ik(x)\,dx$$

$$=\frac{(-W)}{6EI}\{-x^3+3\alpha L\cdot x^2+(3-6\alpha)L^2\cdot x+(3\alpha-2)L^3\} \cdots (3)$$

FIG. 9(a)

STOPPER DISPLACEMENT EQUATION



αL: APPLIED LOCATION OF LOAD
βL: STOPPER POSITION
Ys: STOPPER DISPLACEMENT

$$
\begin{aligned}
Ys &= Yk\,(x=0) + \delta \\
&= Yk\,(x=0) + \beta \cdot L \cdot \tan\{Ik\,(x=0)\} \\
&= \frac{WL^3}{6EI}\{(2-3\alpha)-3\beta(1-2\alpha)\} \quad \cdots(4)
\end{aligned}
$$

$$\sigma\,max = \frac{Mmax}{Z} = -\frac{\alpha LW}{Z} \quad \cdots(5)$$

$$Ys = \frac{L^2}{3\alpha Et}\{(2-3\alpha)-3\beta(1-2\alpha)\} \cdot \sigma\,max \quad \cdots(6)$$

$$Ys = \frac{2L^3}{Ebt^3}\{(2-3\alpha)-3\beta(1-2\alpha)\} \cdot W \quad \cdots(7)$$

FIG. 9(b)

STOPPER DISPLACEMENT EQUATION

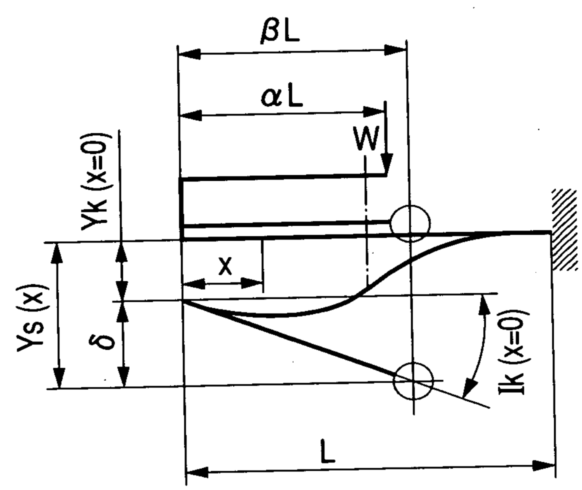


FIG. 10

TABLE III

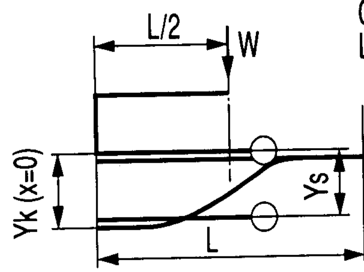
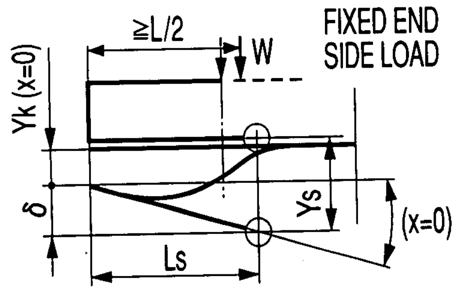
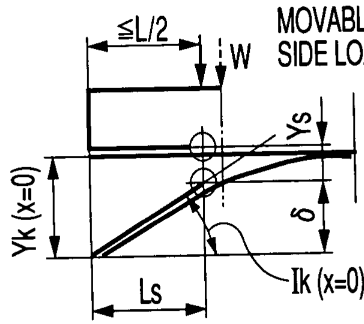
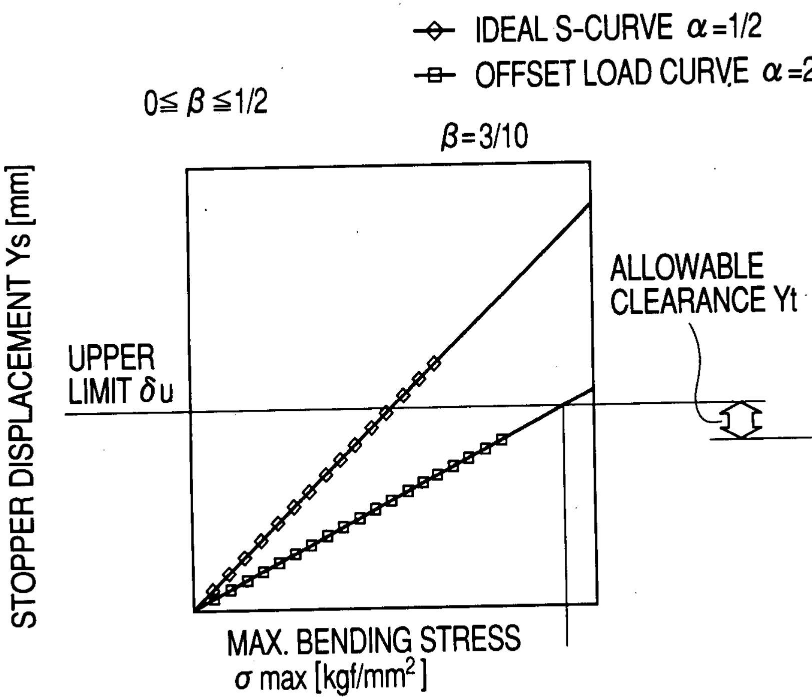
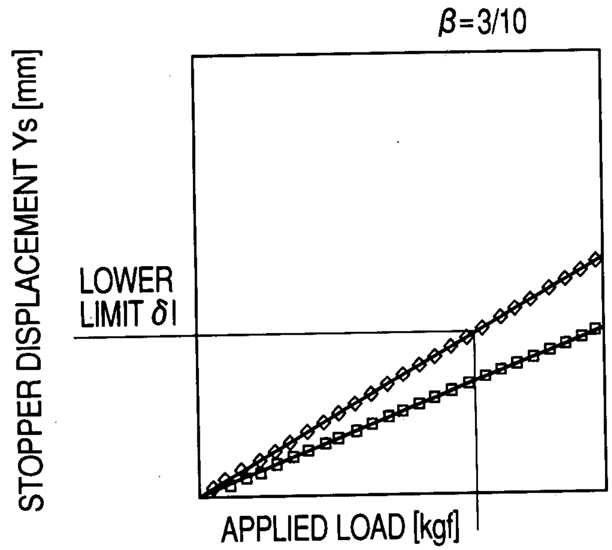
BENDING MODE			STOPPER DISPLACEMENT -TO-POSITION RELATION
IDEAL S-CURVE BENDING MODE			Ys: STOPPER DISPLACEMENT Yk: MOVABLE END DISPLACEMENT Ys=Yk (x=0) STOPPER DISPLACEMENT IS INDEPENDENT OF STOPPER POSITION
OFFSET LOAD APPLY MODE	FIXED END OFFSET LOAD APPLY MODE		δ: STOPPER DISPLACEMENT RESULTING FROM INCLINATION OF MOVABLE END Ys=Yk (x=0) + δ =Yk (x=0) + Ls · tan [Ik (x=0)] STOPPER DISPLACEMENT DEPENDS ON STOPPER POSITION
	MOVABLE END OFFSET LOAD APPLY MODE		Ys=Yk (x=0) - δ =Yk (x=0) - Ls · tan [Ik (x=0)] STOPPER DISPLACEMENT DEPENDS ON STOPPER POSITION

FIG. 11(a)

FIG. 11(b)

STOPPER ALLOWABLE CLEARANCE EQUATION





$$\delta u = \frac{L^2}{2Et}\,\beta \cdot \sigma e \quad \cdots (6, 1)$$

$$\delta l = \frac{L^3 \cdot W1}{Ebt^3} \quad \cdots (7, 1)$$

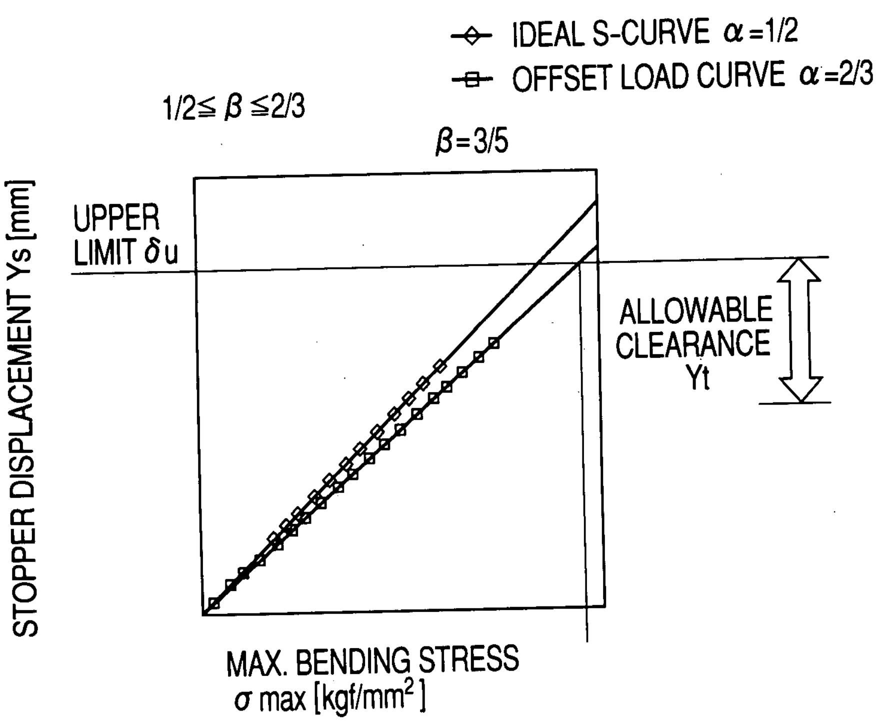
$$\delta u - \delta l = Yt = \frac{L^2}{2Et} \cdot \sigma e \cdot \beta - \frac{L^3 \cdot W1}{Ebt^3} \quad \cdots (8)$$

δl = STRESS LIMIT

W1 = LOWEST LOAD IN LOAD MEASUREMENT RANGE

STOPPER ALLOWABLE CLEARANCE EQUATION

FIG. 12(a)

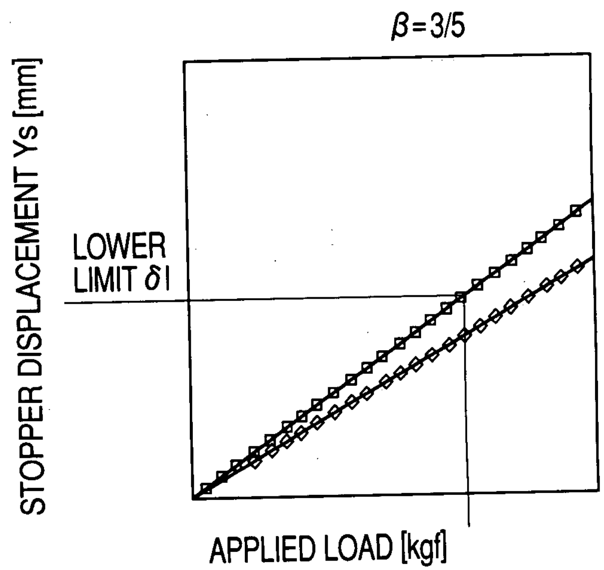


$$\delta u = \frac{L^2}{2Et}\ \beta \cdot \sigma e \quad \cdots (6, 2)$$

$$\delta u - \delta l = Yt = \frac{L^2}{2Et} \cdot \beta \cdot \sigma e - \frac{2L^3 \cdot \beta \cdot W1}{Ebt^3} \quad \cdots (9)$$

δl = STRESS LIMIT

FIG. 12(b)



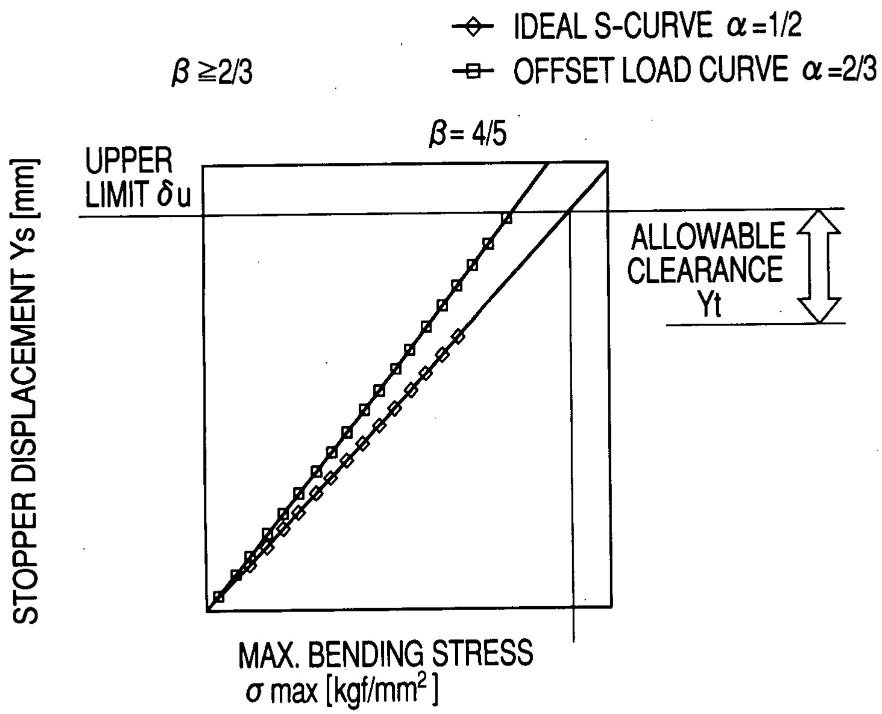
$$\delta l = \frac{2L^3 \cdot \beta \cdot W1}{Ebt^3} \quad \cdots (7, 2)$$

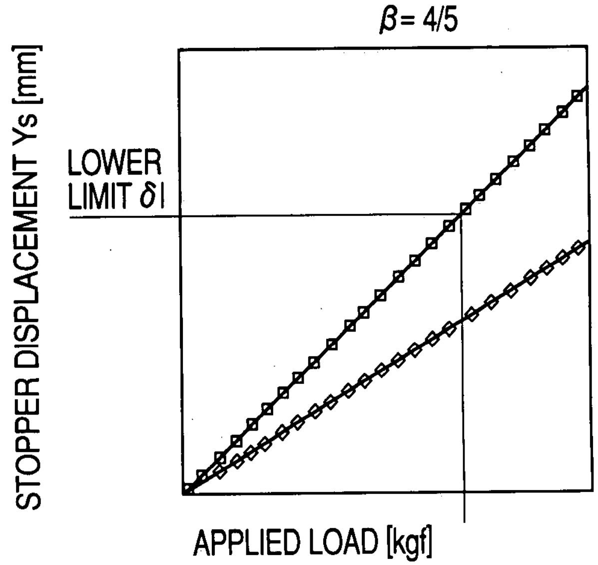
W1 = LOWEST LOAD IN LOAD MEASUREMENT RANGE

FIG. 13(a)

FIG. 13(b)

STOPPER ALLOWABLE CLEARANCE EQUATION





$$\delta u = \frac{L^2}{3Et} \sigma e \cdots (6, 3)$$

$$\delta l = \frac{2L^3 \cdot \beta \cdot W1}{Ebt^3} \cdots (7, 3)$$

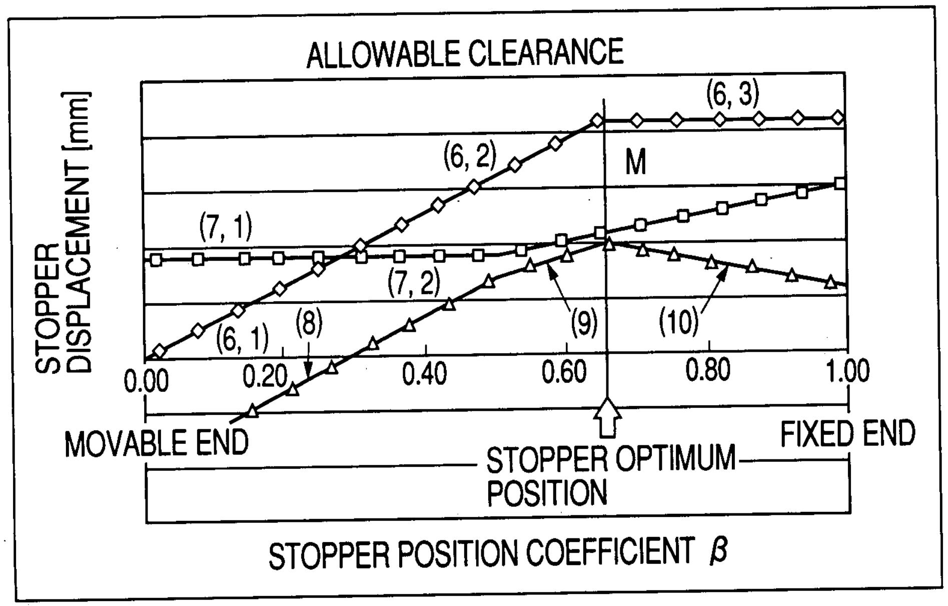
$$\delta u - \delta l = Yt = \frac{L^2}{3Et} \cdot \sigma e - \frac{2L^3 \cdot \beta \cdot W1}{Ebt^3} \cdots (10)$$

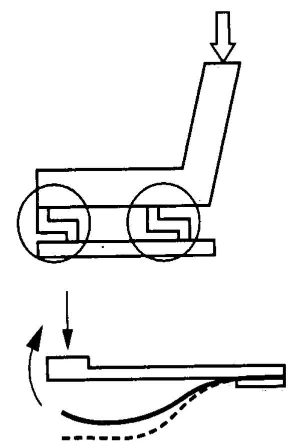
δl = STRESS LIMIT

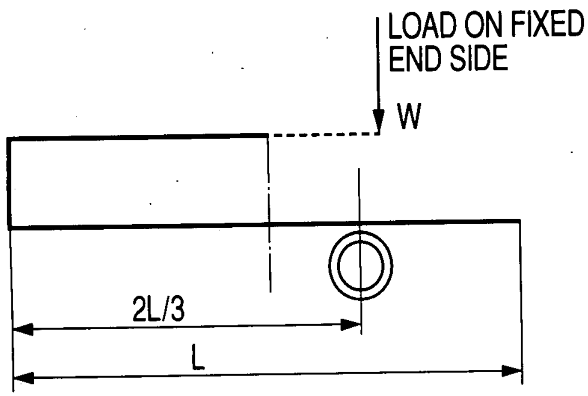
W1 = LOWEST LOAD IN LOAD MEASUREMENT RANGE

FIG. 14

STOPPER OPTIMUM POSITION FOR REAR SENSOR INSTALLED IN SAME DIRECTIONAL FORWARD ORIENTATION WHEN OFFSET LOAD IS APPLIED TO FIXED END SIDE







$$Yt = \frac{L^2}{2Et} \cdot \sigma e \cdot \beta - \frac{L^3 \cdot W1}{Ebt^3} \quad \cdots (8)$$

$$Yt = \frac{L^2}{2Et} \cdot \beta \cdot \sigma e - \frac{2L^3 \cdot \beta \cdot W1}{Ebt^3} \quad \cdots (9)$$

$$Yt = \frac{L^2}{3Et} \cdot \sigma e - \frac{2L^3 \cdot \beta \cdot W1}{Ebt^3} \quad \cdots (10)$$

FIG. 15

STOPPER OPTIMUM POSITION FOR FRONT SENSOR INSTALLED IN SAME DIRECTIONAL FRONTWARD ORIENTATION WHEN OFFSET LOAD IS APPLIED TO MOVABLE END SIDE